



The Puget Sound Clean Cities Coalition Petroleum Reduction Project

PROJECT NARRATIVE

DOE Funding Opportunity: DE-PS26-09NT01236-04

Lead Applicant:
Puget Sound Clean Air Agency – Puget Sound Clean Cities Coalition

May 2009

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1.0 Project Summary

The Puget Sound Clean Cities Coalition Petroleum Reduction Project aims to create an enduring regional collaborative framework to maximize petroleum reduction opportunities in Washington State. The Puget Sound Clean Cities Coalition (Coalition) will accomplish this through the collective acquisition of over 650 alternative fuel and advanced technology vehicles, and the development of alternative fueling infrastructure with fuel from local and sustainable sources. Electric charging infrastructure will be linked to smart grid technology and sourced from photovoltaic panels or local power utilities offering largely renewable sources of electricity such as hydropower. This petroleum reduction project will be implemented in an accountable and measurable manner, through evaluation of common metrics including displacement of petroleum, energy efficiency, greenhouse gas and air pollutant emission reductions, and job creation and retention.

The Project is a collaboration of public agencies, universities, colleges, and businesses that can offer a tremendous leveraging opportunity (60 percent cost-share) for these federal grant dollars to address the need for more regional alternative fuel and advanced technology options, and to increase public awareness and appreciation of the measurable efforts of the Coalition. Coalition members typically contribute to the reduction of petroleum consumption by 4 to 5 million gallons per year. This Project, if fully funded to \$15 million, would increase that amount to at least 160 percent of current levels by reducing petroleum consumption an additional 3 million gallons per year.

The Project is made up of four key Project Areas (A through D) described below, **and in detail in Appendix A.**



Project Area A – Evergreen Fleets – Vehicle and Infrastructure Improvements includes the purchase or conversion of 461 alternative fuel and advanced technology vehicles by 21 public agencies and businesses, the installation of 3 alternative fueling stations, and the installation of \$1.2 million in electric vehicle charging infrastructure in a four-county area. Two additional pilot projects demonstrating the use of solar power to solely charge plug-in hybrid electric vehicles (and battery electric vehicles after 2010) will be installed, to evaluate the effectiveness of electric vehicle solar charging in the Pacific Northwest year-round. The data collected in this project will be reported to partners and used in handbooks and workshops in the region to provide guidance to electrical technicians, homeowners, public agencies, and businesses.



Project Area B – Sea-Tac Airport Ground Support Equipment Electrification includes electrification of 200 pieces of airplane ground support equipment and installation of charging infrastructure at Seattle-Tacoma International Airport (Sea-Tac), which aims to be the first airport in the United States to fully electrify its fleet of ground support equipment. This Project will result in annual reductions of over 400,000 gallons of petroleum and 4,700 metric tons of CO₂ emissions. The focus of this project area will be the gasoline baggage tractors and loading equipment, and will incorporate significant outreach and marketing to airline passengers. The outreach component will include a video-loop about Clean Cities and the airport's program, which will play on screens at each of the 16 baggage claim carousels. More than 30 million passengers travel through Sea-Tac airport each year, offering an unprecedented audience for Clean Cities. There will also be informational window decals at airplane viewing areas, and information about the airport's Clean Taxi program at taxi stands.



Project Area C – Biogas for Buses is a pilot project to fuel buses between the U.S.-Canada border near Bellingham, WA and Sea-Tac Airport (a distance of 100 miles) using compressed natural gas derived from dairy farm digester biomethane. This will be the first project in the U.S. to offer biomethane bus transportation to the public, and will be operational in time to bring tourists to the Vancouver, B.C. area for the 2010 Olympic Winter Games. The biomethane refinery is located in Whatcom County, Washington, which contains one of the largest dairy populations in the nation. The herd at this biomethane refinery could produce over 40,000 gasoline gallons of equivalent (GGE) energy per day and over 15 million GGE per year - enough to fuel 25,000 passenger vehicles at 20 miles per gallon equivalent. The Clean Cities grant funding will support the conversion of 3 buses to natural gas, and the installation of a 100,000 GGE commercial refueling station (the refinery already exists) at the Vander Haak Dairy, including metered fueling, time fill and sequential fast fill.



Project Area D – Advanced Technologies Education and Outreach is an education and marketing program strategically linked to the technologies and infrastructure implemented in the other Project Areas. This Project Area includes curriculum development around electric vehicles and electrical trade programs at colleges and universities, development of workshops for dairy farmers interested in developing biomethane projects, development of guidebooks for residential electric vehicle charging installation, a driver training program linked to the Evergreen Fleets program, and a host of marketing programs including pilot program and fuel station signage, a radio talk show series on electric vehicles, and a television news series aimed at promoting the Clean Cities projects during the week surrounding Earth Day 2011.

Detailed descriptions of Project Areas A through D are provided in Appendix A.

2.0 Project Objectives

The objectives of the Puget Sound Clean Cities Coalition Petroleum Reduction Project are:

- To reduce traditional petroleum consumption by at least 3 million gallons per year by expanding the use of alternative fueled and advance technology vehicles, and the fueling infrastructure necessary to support them.
- To create a regional sustainable market for renewable alternative fuels with the lowest lifecycle emissions, such as biogas made from waste products and solar energy to power electric vehicles.
- To preserve and create at least 350 jobs nation-wide, and enhance our local economy by accelerating the implementation of shovel-ready projects.
- To elevate public awareness and appreciation of the Clean Cities program through innovative outreach campaigns designed to reach an unprecedented audience of over 30 million people per year.

3.0 Merit Review Criterion Discussion

Criterion 1: Probability of Project Success Based on Technical Approach and Work Plan Statement of Objectives

- This project is relevant to the programmatic goals of Clean Cities and the grant requirements because it allows access to alternative vehicles to 21 fleets, reduces petroleum use by more than 3 million gallons per year, increases the viability and deployment of renewable energy technologies, and seeks to acquire only applicable and commercially-available vehicles and infrastructure as outlined in the grant requirements.
- This project will have a high level of success because the alternative fuel and advanced technology vehicles will be purchased through existing agreements (e.g. State Contract), allowing for quick purchase and reliable reporting and tracking. The land on which electric charging infrastructure will be built is already zoned for parking, allowing for rapid installation. The land on which fueling infrastructure will be built is already designated for other fueling or fleet activities. For fueling infrastructure on private land, agreements and permitting are already underway to allow development.
- Data collection is a scheduled task under each project area and will be thorough, tracking fuel consumption, audience/workshop participation, electrical consumption and solar charging capabilities.
- The methodology for which electric charging sites will be selected is based on public access, property ownership, electrical power capabilities, ease of permitting, and projected fleet use. No methodology is needed for determining other alternative fueling sites, which have already been identified.
- At proposed electric charging infrastructure installations, at least 75 percent of the charging hubs will be publicly accessible, with the remaining plugs reserved for fleet use.
- The marketing plan (outlined in the Project Management Plan) for this project includes a comprehensive public education and outreach component, intended to raise public awareness of the alternative fuel initiatives funded under this proposal, as well as of the energy, economic, and environmental benefits of cleaner fuel.
- The fueling station owners (generally local governments) have consented to participating in alternative fuel promotion and displaying availability and price of alternative fuels in a manner similar to postings for conventional fuels (per letters of commitment).
- This project targets the enhancement of alternative fuel infrastructure at existing transportation hubs, including Sea-Tac Airport, local government Park and Rides, local government parking areas, local government fleets, and along US-Canada driving routes.
- The funding requested in this proposal will boost regional investment in vehicle and equipment electrification, as well as explore the potential for expanding biogas for fuel. Whatcom County dairy farms have the potential to increase biogas usage in the county by millions of gallons per year. As fueling infrastructure comes on-line, the stations will become self-sufficient. In the case of electrical infrastructure, this project will be a cornerstone in the development of public destination charging opportunities in the Puget Sound region.
- The proposed Project Management Plan is thorough, and the sequence and duration of tasks has been established by each of the experienced team members. The periodic re-evaluation of the project management plan and risk assessment is also built in to the project timeline to ensure planning is sound and reasonable.
- The work and budget distribution is fair and reasonable, with no project area receiving more than \$5 million. For high value project areas, most of the budget is allocated for the purchase of expensive equipment or vehicles and does not unfairly burden the sub-recipient with additional work.

Criterion 2: Probability of Project Success Based on Team Expertise and Prior Experience

- The team assembled consists of local governments and universities, and reliable partners who are dedicated members of the Puget Sound Clean Cities Coalition and have demonstrated their ability to implement and report on projects of similar size and scope as outlined in the letters of commitment.
- In all cases, the sub-recipients are qualified agencies (Port of Seattle, City of Seattle, Snohomish County, Western Washington University, Washington State University, WorldCNG) with experienced personnel who have demonstrated experience and qualifications as outlined in the attached biographical sketches and letters of commitment.
- Each of the cost-share partners and sub-recipients in this grant is a member of the Puget Sound Clean Cities Coalition. Most have been members for at least 7 years, and most have served on the Coalition's Steering Committee.
- The strength of the partnerships between the local agencies is exemplified by the previous collaborations, e.g. to create fueling infrastructure at SeaTac airport, to participate in Evergreen Fleets at the local government level, and work on a biofuels project with Washington State Ferries and Washington State University.
- The applicant team has the resources to successfully complete the proposed work. The Puget Sound Clean Air Agency has a solid record of achieving goals for state and federally-funded grant projects in a timely and successful manner. It has accounting procedures in place that are compliant with federal auditing and reporting requirements, including on-time submittal of required, quarterly progress reports and final reports.
- The quality of the commitment letters demonstrates that 21 agencies have committed to cost-sharing over \$22 million in vehicles and infrastructure (most of it as cash). The five sub-recipient organizations have also demonstrated their further commitment to adhering to the terms and conditions of the grant as sub-recipients in their commitment letters.

Criterion 3: Ability to Preserve or Create Jobs through Rapid Project Implementation

- The number of direct construction, manufacturing, and maintenance job-years preserved or created through the purchase of vehicles, installation of infrastructure, and development of marketing tools and outreach programs under this project is estimated to be at least 400.
- The number of domestic job-years preserved or created under this project is projected to be at least 350.
- This project will be initiated expeditiously due to the existing state contracts available to purchase vehicles, the planning already completed to electrify Sea-Tac's ground support equipment, and the collection and scrubbing technology already in place at the dairy farm.
- This project has identified the specific sites for all fueling infrastructure and has written commitments indicating the current state of permits or land ownership arrangements as outlined in RFAFT01.doc.
- This project has identified the legal and environmental documentation necessary for installation of infrastructure, and for those sites that do not have the documentation, a process has been outlined for obtaining that documentation in the grant narratives for the particular Project Area.
- This project is ready to proceed with partners (per letters of commitment), has investigated equipment availability (state vehicle and equipment contract), and has many permitting processes underway (e.g. Vander Haak biogas facility).
- This project has outlined a Risk Assessment methodology and Success Criteria within the Project Management Plan to resolve barriers to implementation.
- An increase of skilled labor opportunities is anticipated in the development and maintenance of electric charging infrastructure and the implementation of college/university curricula developed

under this program. More skilled labor for natural gas vehicle conversion, fueling infrastructure construction, and biogas facility production is also anticipated.

- The vehicles using the fuel/charging infrastructure have been identified as (1) local government fleets; (2) local taxi and shuttle fleets serving the airport; (3) bus fleets in the Bellingham area; and (4) Nissan North America's 1000 battery electric vehicles available in the Seattle area in 2010 (per MOU).

Criterion 4: Energy Security and Environmental Benefits from Petroleum Displacement and Emission Reduction

- This project will reduce petroleum-based fuel consumption by at least 3 million gallons per year, an increase of 160 percent over current levels associated with Coalition members. It will also create opportunities for further reductions by installing electric vehicle charging stations and biogas fueling facilities that will be used by vehicles beyond those identified in the project.
- The estimate of the quantity of fuel to be displaced is sound and based on existing use and application of vehicles that will continue beyond the life of this Project.
- The vehicles using the alternative fuel or being converted to use natural gas are all less than two years old, therefore maximizing their alternative fuel use over the expected period of ownership. This is especially relevant for taxi fleets that are purchasing new vehicles for the purpose of conversion and will experience high use.
- The amount of fuel displacement that will occur over the period of ownership is based on the general fleet 'useful life' calculation of 120,000 miles. For taxi fleets, this was extended to reflect true-to-life use of taxis and shuttles (approximately seven years). For airport ground support equipment, this was extended to reflect current practices of 20 year retention.
- This project will contribute to a sustainable alternative fuel and vehicle market by developing new sources for fuel and converting hundreds of vehicles to run on compressed natural gas, creating a captive market for the fuel. The large outreach/educational component will also help create an understanding of, and a demand for, a large number of electric vehicles and charging infrastructure.
- Plans to continue deployment of vehicles and infrastructure extend beyond this project, as outlined in the Coalition's long term strategy to expand the use of biogas, to expand the use of natural gas in taxi and shuttle fleets, and support the Evergreen Fleets program.
- The probability that this project will lead to market transformation is high for electricity and natural gas, particularly in Whatcom County, where the current use of natural gas or biogas is extremely low, and the potential sources and cost savings for users are high.
- Funding will continue for several aspects of this program due to commitments and partnerships created prior to this grant. The Evergreen Fleets program is self-sustaining, and state mandates for alternative fuel and electric vehicles will ensure local fleets obtain more alternative vehicles in the future. As well, the funding for the biogas facility will be self-sustaining because the waste gas is produced from an existing business (dairy farm).
- The reduction of greenhouse gases associated with this project is more than 7,500 metric tonnes of CO₂ per year, using a combination of the GREET model and Washington State electricity production emission factors. Common air contaminant reductions associated with new or retrofitted vehicles were calculated to be more than 218 tonnes per year using GREET, including 68 tonnes of smog-forming pollutants (NO_x, VOCs, PM_{2.5})

Criterion 5: Project Cost and Cost-share

- The cost-effectiveness of this program is very high because the total request for 666 vehicles and 4 fueling stations, and several hundred electric charging stations will be acquired for a cost-share of approximately 70 percent (total project cost-share is 60 percent).
- The cost-effectiveness of this project is very high because the cost per gallon displaced per year of the operational phase of this project is \$2.50 (\$7.5 million/3 million gallons).
- The cost-effectiveness of this project is very high because the cost per gallon displaced during the expected period of vehicle ownership is less than \$0.70. When the fueling/charging infrastructure displacement is added to that, the cost per gallon during period of ownership reduces to \$0.54.
- The financial commitment demonstrated by the team partners is very high as demonstrated by the commitment letters showing a 60 percent cost-share.

4.0 Relevance and Outcomes/Impacts

The Puget Sound Clean Cities Coalition (Coalition) has a strong desire to be a national leader in the sustainable use and market establishment of alternative fuel and advanced technology vehicles and their supporting infrastructure. This project is aligned with the Coalitions' strategic plan, which focuses on increasing access to alternative fueling stations and promoting fleet greening practices. Coalition partners have demonstrated their commitment to carrying out Coalition initiatives through the installation of CNG and biodiesel alternative fueling stations, and purchase of thousands of alternative fuel and advanced technology vehicles in the Puget Sound over the last decade. The funding requested in this proposal would greatly advance the Coalition's realization of its strategic vision, facilitating the purchase of over 650 alternative fuel and advanced technology vehicles that were specifically targeted to replace high-consumption fleet vehicles, and accelerating the demand for cleaner, more sustainable fuels. It's estimated that with full funding, this project will reduce annual petroleum fuel consumption in the region by at least 3 million gallons.

The Coalition specifically places a high priority on those fuels that are developed from sustainable, low-carbon, and local sources. This project promotes the development of a sustainable, diverse, locally-sourced fuel economy by taking advantage of the region's agricultural assets and natural resources. For example, Snohomish County is running two-thirds of its fleet on B20 and is developing a market for locally-grown seed crops, with roughly 950 acres of local farmland now being planted with canola and other oilseed crops. The dairy biogas project in Whatcom County offers a more cost-effective use for fugitive dairy emissions. From an economic perspective, the very low price of electricity in Washington State has previously deterred the development of biogas-related projects because the gas has traditionally been used to generate electricity and sold back to the utility or used on-farm. By converting the biogas to natural gas and selling it to local fleets (and using it for farm operations), the economic and environmental benefits become self-sustaining for the farm.

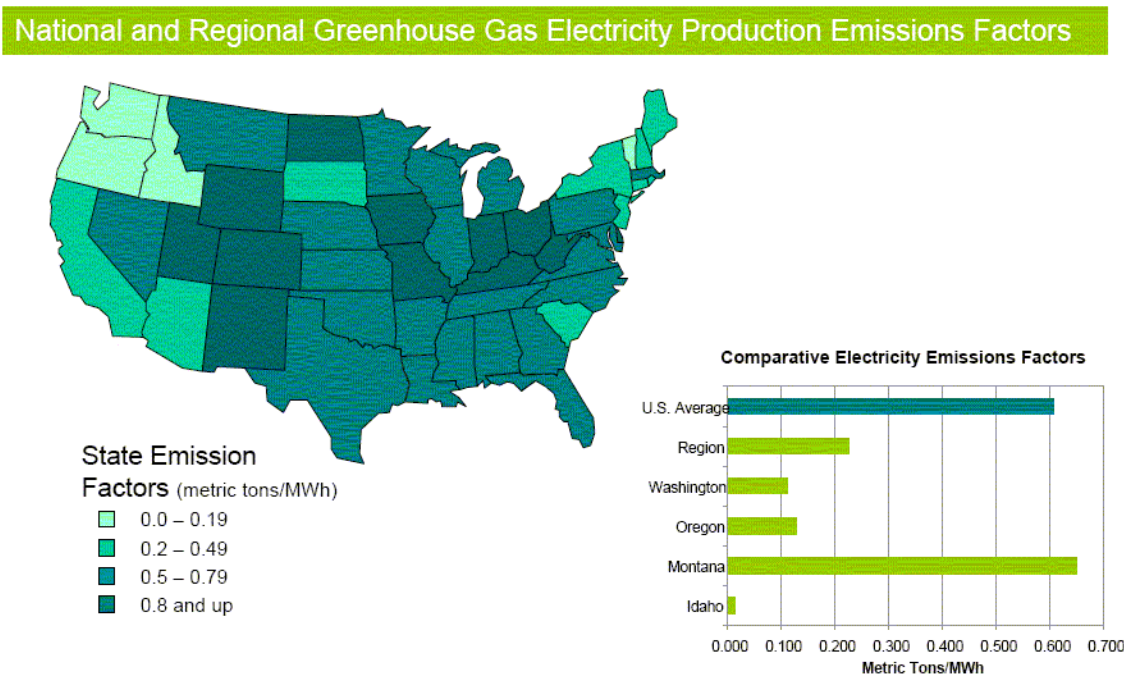
The advent of full-speed battery electric vehicles is also having a profound effect on the priorities of the Puget Sound region and the Coalition members. In April 2009, Nissan North America announced it would make at least 1000 full-speed battery electric vehicles available to the Seattle region in late 2010. From an environmental and economic perspective, using electricity to power a significant number of light-duty vehicles in the region makes great sense. The greenhouse gas and pollutant emission factors for Washington State-based power generation are among the lowest in the nation, with the vast majority of production coming from hydro-power. For this same reason, the rate per kWh is also among the lowest in the nation, and means the Puget Sound region is enthusiastically awaiting more opportunities to use electric vehicles and build the infrastructure to support them, as reflected in this grant proposal. In fact, some local government fleet managers are deliberately delaying fleet vehicle change-outs so they can

replace existing vehicles with battery electric options when they become available in the coming two years.

The environmental benefits of this project were calculated in terms of greenhouse gas emission reduction, and common air contaminant (CO, NO_x, VOCs, PM_{2.5}) reduction, using the simplified GREET model provided specifically by the Department of Energy for this grant. However, a simple calculation of emission reduction benefits using local electricity production emission factors produced a significant difference in benefits when compared with the GREET calculations. Figure 1.0 shows the average CO₂ emission factor for Washington State to be near 0.10 metric tonnes per MWh (or 0.0001 tonnes per kWh). Applying this factor to the Sea-Tac Airport project replacing 202 pieces of gasoline and diesel powered ground support equipment (GSE), a reduction of 4,727 metric tonnes of CO₂ is achieved. For comparison, the simplified GREET model, using a U.S. average power production emissions profile, and assuming GSEs travel 60 miles per day (fuel consumption rather than vehicle miles traveled is recorded for GSEs, so this must be estimated), results in a CO₂ reduction benefit of only 509 metric tons for the airport equipment as shown in Table 2. This is a difference of more than 4,000 metric tonnes per year compared with the calculations presented in Table 1, and it is therefore assumed that the GREET model dramatically underestimates the benefits associated with local and sustainable sources of fuel such as electricity, natural gas produced from waste biogas, and biodiesel produced from locally grown feedstock.

Common air contaminant reductions associated with new or retrofitted vehicles were calculated to be more than 218 tonnes per year using GREET, including 68 tonnes of smog-forming pollutants (NO_x, VOCs, PM_{2.5}), as shown in Table 2.0.

Figure 1.0 – Electricity Production CO₂ Emission Factors



Source: U.S. Energy Information Administration "Updated State and Regional Level Greenhouse Gas Emission Factors for Electricity (March 2002).

Table 1.0 – CO₂ Emission Reductions from Project Area B

Ground Support Equipment Type	Qty	Petroleum Consumption per Year (gallons)	Petroleum CO ₂ per Year (metric tonnes)*	kWh per year	Electrical CO ₂ /Year (metric tonnes)**	CO ₂ Reduction (metric tonnes)
Baggage Tractor	135	295,650	3583	2,463,750	246	3337
Pushback Tractor	45	98,550	1194	903,375	90	1104
Belt Loader (driver operated)	10	10,950	133	18,250	2	131
Belt Loader (walk behind)	12	13,140	159	35,040	4	155
Total		418,290	5069		342	4727

*Based on an 80% gasoline, 20% mix of fuel use in the existing GSE. The emission factor for gasoline is 26.1 lbs CO₂/year, and the emission factor for diesel is 29.2 lbs CO₂/year.

** Based on emission factor of 0.0001 tonnes/kWh (or 0.1 tonnes/MWh)

Table 2.0 – Petroleum Displacement and Emission Reductions from Project Vehicles (per year)

Vehicle	Qty	Petroleum displacement/yr	miles/day/vehicle	CO credit (lbs)	VOC credit (lbs)	NOX credit (lbs)	PM2.5 credit (lbs)	GHG credit (lbs)
Chevy Impala	185	1480000	329	220725	18813	33596	49	4995326
Chevy Express Van	20	160000	329	23862	2034	3632	5	540035
Ford E450 Shuttle Van	17	85000	110	3265	363	16943	218	43635
Volvo Vactor HD Truck	2	13000	55	192	21	997	13	2567
MCI F Coaches	3	22500	164	859	95	4458	57	11480
Ford Escape Hybrid	65	10400	26	7404	453	904	1	175417
Toyota Prius Hybrid	46	8280	26	5240	321	640	1	124141
Customizable Step Van	14	5250	16	391	43	1820	26	17123
Honda Insight Hybrid	1	65	8	35	2	4	0	830
Columbia Mega or similar NEV truck	1	300	10	55	3	6	0	1118
Chevy Silverado (or better) Hybrid Pickup T	8	1280	33	1157	71	141	0	27402
Customizable Heavy Duty Hybrid Trucks	24	28800	30	1257	140	5850	84	55037
Toyota Camry Hybrid	5	400	14	307	19	37	0	7266
Honda Civic	13	6045	33	1556	133	237	0	35209
GEM eL	4	1200	10	220	12	22	0	4474
GMC Yukon Hybrid SUV	2	400	41	359	22	44	0	8511
Chevy Malibu Hybrid	24	4080	42	4416	270	539	1	104628
Mercury Milan Hybrid	2	650	47	412	25	50	0	9757
Azure Dynamics Hybrid Minibus	28	35000	82	4009	445	18655	268	175506
Charlotte Airport Baggage Tractors	135	295650	60	44612	2529	4530	32	905933
Pushback Tractors	45	98550	60	5240	1084	28951	370	143385
Belt Loader (Driver Operated)	12	13140	30	1983	112	201	1	40264
Belt Loader (Walk Behind)	10	10950	30	1652	94	168	1	33553
Total	666	2280940		329209	27105	122424	1129	7462597
Total in Metric Tons				149	12	56	1	3392

The fuel displacement calculations shown in Table 2.0 were calculated using the fleet average fuel consumption for the current conventional vehicle. Wherever possible, the fuel economy in miles per gallon for a gasoline or diesel version of the vehicle was compared against the advanced technology or alternative fuel vehicle fuel economy (average of U.S. Environmental Protection Agency's city/highway fuel economy ratings). The fuel displacement per year for the fueling stations was based on the information provided in the attached fueling station table (RFAFT01.doc). Based on these two estimates, the fuel displacement per year is projected to be 3.5 million gallons. A conservative estimate accounting for slower adoption of electric vehicles and biogas in the first 2 years of project implementation is 3 million gallons. Over those first two project years, with a federal investment of \$15 million, the cost per gallon reduced would therefore be \$2.50.

The fuel displacement over the life of the vehicles was calculated using a change-out formula of 120,000 miles, although in the case of taxis and shuttle buses, this was extended to 7 years regardless of mileage. Airport ground support equipment is typically used for at least 20 years, and thus an exemption was made for these vehicles as well. Using these criteria, the expected gallons displaced per vehicle ownership life for all vehicles was estimated to be 21.4 million gallons. The cost per gallon displaced during the

expected period of vehicle ownership would therefore be less than \$0.70. When the fueling/charging infrastructure displacement is added to that (assuming 5-year ownership of fueling stations before upgrade or sale occurs), the cost per gallon during period of ownership reduces to \$0.54.

The economic impacts of this project would be experienced in all areas of implementation and across the nation. The project area includes 5 counties, 11 cities, and 5 congressional districts. The main economic benefit of this project is job retention and creation among vehicle manufacturers, vehicle dealers, CNG conversion companies and their mechanics, fuel station construction, electrical charging station construction and installation, design, marketing and public relations firms, and education. According to the estimates of job creation from the American Recovery and Reinvestment Act of 2009, approximately \$92,000 of government spending creates one job-year (Executive Office of the President Council of Economic Advisors, May 2009). Using this formula, for this project of \$37.6 million, approximately 409 job-years would be retained or created. The majority of these jobs would be domestic as the bulk of the spending is on domestically produced vehicles and infrastructure. Using the vehicle data in Table 2.0, the value of foreign-made automobiles is less than \$2 million, which would translate to approximately 22 job-years. It would therefore be reasonable and conservative to suggest that for the project total (including vehicles, infrastructure, and marketing products), at least 350 domestic job-years will be retained or created through this Project. Discussions with local Coalition members suggest the ratio of \$92,000 to 1 job is reasonable. For example, WorldCNG estimates that they will require eight staff members to perform the retrofit work outlined in this proposal. The value of the WorldCNG project labor budget is \$808,000, which equates to 8.8 jobs using this formula.

5.0 Roles of Participants

The lead applicant for this grant funding is the Puget Sound Clean Air Agency (Agency), within which is housed the Puget Sound Clean Cities Coalition (Coalition). The Agency will assume financial responsibility for the resultant agreement with the Department of Energy, while the Coalition Coordinator will oversee implementation of this project with sub-recipients. Sub-recipients include the Port of Seattle, City of Seattle, Snohomish County, Washington State University, WorldCNG, and Western Washington University. These entities will manage their portions of the grant.

Participant role descriptions:

Lead Agency

Puget Sound Clean Air Agency/Puget Sound Clean Cities Coalition – the Agency will manage the “rebate” program for the incremental cost of vehicles when evidence of purchase is provided by the organizations who committed vehicle base cost-share in their letters of commitment. The Agency will also manage the \$700,000 electric charging infrastructure for local governments via a state contract or the National Joint Powers Alliance as outlined in the letters of commitment. The Agency will work with local governments to determine the exact locations and priorities for the charging installations as outlined in Appendix A. The Agency will also manage the marketing contracts as outlined in the Marketing Plan found within the Project Management Plan document.

Sub-Recipients

Port of Seattle – Working with a consortium of Sea-Tac airline tenants, Port of Seattle will purchase and manage the installation of charging infrastructure for electric ground support equipment, and the conversion/replacement of identified equipment. The Port of Seattle and its tenant airline

carriers/consortium would match costs in terms of cash toward the purchase of ground support equipment. The Port will also monitor and provide data on electric charging usage for reporting purposes.

City of Seattle – Due to the large number of, and specific requirements for, fifteen (15) heavy duty diesel hybrid vehicles, the City of Seattle will be responsible for bidding the hybrid engine and complete chassis for these vehicles. The City will also be responsible for contracting out the installation of electric vehicle charging stations on City property (primarily designated parking areas). At least 75 percent of the electric plug-ins must be accessible to the public. The City will monitor electric charging usage for reporting purposes.

Snohomish County – Snohomish County will contract out the installation of five alternative fueling stations within county boundaries on government-owned property as outlined in RFAFT01.doc. Most of the planning and cost estimates have been completed, but some of the permitting for sites without fueling infrastructure are not yet underway. The County will work with its partners to complete the installation and ensure compliance with all safety and environmental laws. The County will monitor solar charging potential and vehicle charging usage, as well as alternative fuel sales for reporting purposes.

WorldCNG – the company will be responsible for retrofitting vehicles identified in the letters of commitment using certified natural gas conversion kits. All certifications are attached, and the exact vehicles (with model year) to be converted are outlined in the ICAFVT02.doc document.

Western Washington University (WWU) – the Vehicle Research Institute at WWU and its partners will work with existing partners to install a slow-fill and fast-fill fueling station at an existing biogas refinery in Whatcom County at Vander Haak Farms. Permitting with the Northwest Clean Air Agency, Department of Ecology, and the county (fire marshall and officials) is currently underway. WWU will work with partners at Bellair Charters and Cummins NW to retrofit coach buses to natural gas, which will then consume the biogas produced at the Vander Haak facility. After PSCAA provides the contracted design work for bus ‘wraps’, WWU will be responsible for ensuring these are mounted on the buses for the purpose of education, marketing, and outreach.

Washington State University (WSU) – the Energy Extension Program at WSU will contract out work for the purpose of curriculum development around electric vehicles and electrical trade programs at colleges and universities, development of workshops for dairy farmers interested in developing biomethane projects, development of guidebooks for residential electric vehicle charging installation, and a driver training program linked to the Evergreen Fleets program.

Additional program participants include the following cost-share or service providers:

Bellair Airporter Shuttle, Bravo Environmental, BYG Taxi Co-Op, City of Bellevue, City of Everett, City of Issaquah, City of Kirkland, City of Mercer Island, City of Olympia, City of Renton, City of Sammamish, City of Tacoma, King County, MasterPark, SeaTacPark, STITA Airport Taxi, Tacoma Public Utilities, University of Washington, State of Washington Procurement Office, National Joint Powers Alliance, Alaska Airlines, Vander Haak Dairy, Shoreline Community College, and Wenatchee College.

6.0 Facilities and Other Resources

The Puget Sound Clean Air Agency (Agency) has been the recipient of several U.S. Environmental Protection Agency and Department of Energy grant awards and has a solid record of successfully managing and implementing federally-funded projects in a timely and successful manner. The Agency

has experienced grant managers on staff and other resources necessary to manage this project. The Agency has accounting procedures in place that are compliant with federal auditing and reporting requirements, including on-time submittal of required, quarterly progress reports and final reports.

Stephanie Meyn, the Puget Sound Clean Cities Coalition Coordinator within the Puget Sound Clean Air Agency, will oversee the project. An additional employee of the Puget Sound Clean Air Agency will be hired to provide fiscal and project management duties and will coordinate, write and submit all required reports related to this contract.

General administration of the project will be coordinated from the offices of the Puget Sound Clean Air Agency, located at 1904 Third Avenue, Suite 105 in downtown Seattle, Washington. The Agency is a fully operational government entity equipped with the resources (capital and human) needed to oversee this project.

7.0 Equipment

The equipment needed to install any infrastructure or parts in this Project will be competitively contracted out through appropriate vendors who have a demonstrated history and performance record, and meet all applicable labor, safety, and environmental requirements for their services.

8.0 Statement of Project Objectives

Project Title: Puget Sound Clean Cities Coalition Petroleum Reduction Project

A. OBJECTIVES

The objectives of the Puget Sound Clean Cities Coalition Petroleum Reduction Project are:

- To reduce traditional petroleum consumption by at least 3 million gallons per year by expanding the use of alternative fueled and advance technology vehicles, and the fueling infrastructure necessary to support them.
- To create a regional sustainable market for renewable alternative fuels with the lowest lifecycle emissions, such as biogas made from waste products and solar energy to power electric vehicles.
- To preserve and create at least 350 jobs nation-wide, and enhance our local economy by accelerating the implementation of shovel-ready projects.
- To elevate public awareness and appreciation of the Clean Cities program through innovative outreach campaigns designed to reach an unprecedented audience of over 30 million people per year.

Specific objectives of the Project, by Project Phase, are:

- **Phase I – Planning:** To fully review and develop all aspects of the Project Management Plan for successful implementation of the Project.
- **Phase II – Implementation:** To successfully procure vehicles and infrastructure funded under this proposal, and develop outreach and marketing tools to support them.
- **Phase III – Reporting:** To provide comprehensive, thorough, and timely Project Reports in accordance with all grant requirements.

The Scope of Work proposed herein involves the acquisition of over 650 alternative fuel and advanced technology vehicles, and the development of infrastructure supported by local and sustainable alternative fuel sources. Infrastructure will include the installation of one new E85 tank/pump; two new alternative fueling stations (B20); two solar plug-in demonstration sites; one new biogas (CNG) station; and at least 300 new electric charging hubs in cities and at the airport. Electrical charging infrastructure will be linked to smart grid technology where possible and sourced from local power utilities offering largely renewable sources of electricity such as hydropower. The project will be implemented in three phases.

In Phase II: Implementation, the Recipient shall ensure that all sub-recipients and committed partners implement the tasks necessary to procure the vehicles and infrastructure, and create outreach and marketing products. The Recipient shall also ensure that appropriate data collection occurs for reporting requirements related to grant requirements, and needed in Phase III.

C. TASKS TO BE PERFORMED

Upon award of funding requested under this proposal, the Puget Sound Clean Cities Coalition program manager will convene meetings with each of the sub-recipients, Agency personnel, and team partners to commence the Planning Phase as outlined in the Tasks below.

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Phase I: Planning

Task 1.0 – Update Project Management Plan

The Recipient will provide the daily management control necessary to monitor technical progress and expenditures of the work and assure all technical, schedule, reporting and budget requirements are met. A project management plan (included as a separate attachment in this grant application) will be updated upon grant award and will be consistent with established project management practices. The plan will provide sufficient information to document the purpose and scope of the project, the planned approach, resource allocation, and the work breakdown structure, schedule and milestones. A team approach, or Delphi Technique, will be used to confirm time range estimates for completing major milestone tasks. The report will describe how all phases of the project are coordinated and integrated (i.e., vehicle purchases and fueling site selection; acquisition of equipment, site preparation, installation, outreach and educational programming, and operational support).

Task 2.0 – Confirm existing personnel roles or hire key personnel (All Team Members)

Outline and define roles for personnel involved with this project, hire new personnel as needed.

Task 3.0 – Project finance and accounting activities (All Team Members)

Establish financial roles and confirm budget time-lines for appropriate budget periods for all sub-recipients and cost-share partners.

Task 4.0 – Finalize contracts and legal agreements (All Team Members)

Establish all contracts, and ensure legal agreements for cost-sharing, rebates, and state procurement contracts are in place before work begins.

Phase II: Implementation

Project Area A – Evergreen Fleets Vehicles and Infrastructure

Task	Description	Responsible Entity
5	Establish rebate program: Ensure all cost-share partners are familiar with program requirements to obtain rebate checks for incremental cost of alternative vehicles	Puget Sound Clean Air Agency (PSCAA)
6	Purchase vehicles through state contracts or established joint powers: Cost-share partners purchase vehicles per their commitments and time-lines.	Cost-share partners who committed to purchasing vehicles as outlined in Cost-Share of Budget
7	Commence retrofits of vehicles: Those cost-share partners who committed to purchase or procure vehicles for the purpose of natural gas retrofits will schedule these tasks with WorldCNG	WorldCNG and cost-share partners
8	Bid fueling and solar charging infrastructure: For all stations in Snohomish County as indicated in RFAFT01.doc	Snohomish County
9	Install Fueling and Solar Charging Infrastructure: For all stations in Snohomish County as indicated above.	Snohomish County
10	Bid Charging Infrastructure: Within City of Seattle and greater Puget Sound region under two separate contracts	City of Seattle, PSCAA
11	Install Charging Infrastructure: Within City of Seattle and greater Puget Sound region under two separate contracts	City of Seattle, PSCAA
12	Collect Data: Fueling consumption data by month for vehicles and infrastructure, electrical consumption by hour for charging stations.	PSCAA along with infrastructure and vehicle use partners

Project Area B – Electrification of Ground Support Equipment at Sea-Tac Airport

Task	Description	Responsible Entity
13	Design infrastructure for charging stations: In partnership with airline consortium, establish location and strategy for GSE charging infrastructure	Port of Seattle
14	Bid infrastructure installation: Based on design specifications, bid for parts and labor to install electrical charging infrastructure at airport.	Port of Seattle
15	Purchase ground support equipment: Purchase GSEs as outlined in ICAFVT02.doc	Port of Seattle
16	Build infrastructure: Install charging station infrastructure using successful bidder.	Port of Seattle
17	Collect Data: Electrical consumption by hour for charging stations	Port of Seattle

Project Area C – Biogas for Buses --Vander Haak Dairy Biomethane Transportation Pilot

Task	Description	Responsible Entity
18	Retrofit buses: Get MCI coaches retrofit to run on compressed natural gas	Western Washington University (WWU) in partnership with Bellair and Cummins NW
19	Install fueling infrastructure: Complete fast-fill and slow-fill natural gas fueling infrastructure in conjunction with biogas refinery at Vander Haak dairy.	WWU
20	Mount bus wraps: Using design provided by Puget Sound Clean Air Agency contract, contract out mounting of bus wrap to advertise biogas projects to traveling public.	WWU
21	Collect data: Collect fuel consumption, sales, and bus passenger loads.	WWU

Project Area D – Advanced Technologies Education and Outreach

Task	Description	Responsible Entity
22	Contract out workshops for dairy industry and others interested in exploring digester gas conversion to fuel and for general public on vehicle electrification if budget allows.	Washington State University (WSU)
23	Design and distribute curricula: For electrical and solar programs at universities and colleges, plus driver training program for Evergreen Fleets.	WSU
24	Design and distribute electric charging handbook: In partnership with utilities, building inspectors, etc., develop handbook for homeowners and businesses interested in installing vehicle charging units.	WSU
25	Design and distribute marketing materials: Contract out design and development of materials as outlined in the Marketing Plan (Project Management Plan).	Puget Sound Clean Air Agency
26	Collect data: Workshop attendance, materials distributed, participant feedback.	WSU

Phase III: Reporting

Task 27 - Analyze Collected Data (Puget Sound Clean Air Agency)

The Recipient shall gather all necessary project information from team partners and sub-recipients to participate in Department of Energy merit reviews, performance audits, and to insure knowledge transfer and analysis.

Task 28 - Report on Collected Data (Puget Sound Clean Air Agency)

The Recipient shall write the reports as per the deliverables outlined in Section E.

D. CRITICAL PATH PROJECT MILESTONES

Milestone	Completion Date	Responsibility
Vehicle Purchases and Retrofits	70% complete by Sept 2010; 100% by Sept 2011	Evergreen Fleets cost share partners
Fueling Infrastructure Installed	Complete by April 2011	Snohomish County
Electric Charging Infrastructure Installed	50% installed by April 2010; 100% by Sept. 2011	City of Seattle Puget Sound Clean Air Agency and cost-share partners in local governments
Airport GSE purchased	50% by Oct. 2010, 100% by Sept. 2011	Port of Seattle
Airport Charging Infrastructure Installed	50% by Jan. 2011, 100% by Sept. 2011	Port of Seattle
Biogas Station Installed	February 2010	Western Washington University
Bellair Buses Retrofit and 'wrap mounted'	1 bus by Feb 2010, others by Dec 2010	Western Washington University
Conduct workshops	50% complete by Dec 2010; 100% by Sept. 2011	Washington State University
Design and distribute curricula	Complete by Sept. 2011	Washington State University
Design and distribute marketing materials	Fueling marketing complete 50% complete by Oct. 2010; 100% by Sept. 2011.	Washington State University
Design and distribute Electrical installation handbook	Complete by Jan 2011	Washington State University
Write Project Summary Report	Collect data by Sept. 2012; Submit report by Sept. 2013.	Puget Sound Clean Air Agency

E. DELIVERABLES

The deliverables for this Project, other than those identified on the Federal Assistance Reporting Checklist, include the following:

- 1) Full Project Report summarizing data collected during contract performance period (implementation)
- 2) Evidence of purchase (receipts, purchase orders, etc.) or retrofit of vehicles outlined in ICAFVT02.doc
- 3) Installation of alternative fueling equipment outlined in RFAFT01.doc
- 4) Evidence of workshop participation and evaluations
- 5) Copy of curricula for colleges and universities, and a distribution summary
- 6) Marketing materials for airport and vehicles and buses
- 7) Electric vehicle charging guidebook for residents and electricians
- 8) Biogas literature

Appendix A

Project Area A – Evergreen Fleets - Vehicle and Infrastructure Improvements

In the Puget Sound region and in Washington State, transportation is the leading contributor (60%) of greenhouse gas emissions and diesel particulate matter. Reducing fossil fuel consumption provides economic, environmental, and national security benefits. With these trends in mind, the Puget Sound Clean Air Agency and Puget Sound Clean Cities Coalition launched a green fleet certification program called Evergreen Fleets, an effort to engage fleets in voluntary actions to reduce vehicle emissions.

The Evergreen Fleets (evergreenfleets.org) certification system is intended to recognize and reward all fleets taking significant steps to green their fleets, reserving the highest levels of recognition for those organizations achieving substantial greenhouse gas reductions from fleet operations. An Advisory Committee, composed in large part by the agencies applying for vehicles and infrastructure under this grant, used the goals set by the State Legislature and Governor Christine Gregoire as the guidepost for the design of the greenhouse gas emission reduction targets.

Already several Evergreen Fleets members have made substantial investments in clean fuels. Snohomish County, for example, is running two-thirds of its fleet on B20. The county is also developing a market for locally-grown seed crops, with roughly 950 acres of local farmland now being planted with canola and other oilseed crops. The work envisioned in this Project Area will bolster the availability and accessibility of alternative fuels in Snohomish County (with the addition of 3 biofuel stations), as well as the greater Puget Sound region. Taxi and shuttle fleets like STITA, who consume tremendous amounts of fuel (each taxi consumes approximately 8,000 gallons of gasoline per year), have also taken the initiative by converting to natural gas. This proposal includes several new taxi/shuttle fleets in the region who previously only consumed gasoline.

Under this proposal, a range of private and government fleets seeking Evergreen Fleet certification are partnering to purchase or convert a total of 461 alternative fuel vehicles and build three alternative fueling stations, two solar demonstration sites, and at least 90 electric charging hubs in the greater Seattle / Puget Sound region. A rebate program, housed within the Puget Sound Clean Air Agency, will issue rebate checks for the incremental cost of vehicles to the cost-share partners after evidence of purchase is produced (per conditions based on original vehicle purchase commitment in this grant). The Agency has conducted similar rebate programs (Woodstove Change-out Program), and has a demonstrated history and understanding of the procedures to ensure it works effectively. The General Administration State of Washington Vehicle Acquisition Team special purchasing program offers most of the vehicles listed in this grant on the state contract. The State has an electronic receipt system which will make it fast and effective for producing rebate checks to cost-share partners. For those vehicles not listed on the state contract, partners may use the National Joint Powers Alliance contract (see commitment letters) or a pre-approved vehicle provider. For those cost-share partners seeking natural gas vehicle conversion, the partners will work with WorldCNG to arrange to have the rebate taken directly off the full price of the conversion kit per each installation.

Due to the high level of interest and anticipation of full-speed battery electric vehicles in the region in 2010, installation of \$1.2 million in electric vehicle charging infrastructure in a four-county area is also proposed. The sites for the installation will be on local government property already zoned and converted to parking. At project commencement, participating governments will provide a list of their priority sites for charging infrastructure and provide site criteria details (e.g. public access, property ownership, electrical power capabilities, ease of permitting, projected fleet use, etc). The site priority among all partners will be determined using these criteria, and installation will proceed using equipment and labor bids from a collective contract (either through a state contract or via an intergovernmental agreement) that

offers a variety of Level 1 and 2 charging stations (fee-based or direct-to-grid, depending on client needs). For the City of Seattle, charging infrastructure on City property in the amount of \$500,000 will be accomplished through a separate contract, but must adhere to the standard of 75 percent charging access for the public.

Two additional pilot projects demonstrating the use of solar power to solely charge plug-in hybrid electric vehicles (and battery electric vehicles after 2010) will be installed in Snohomish County at a highly visible Park and Ride, to evaluate the effectiveness of electric vehicle solar charging in the Pacific Northwest year-round. The data collected in this project will be reported to partners and used in handbooks and workshops in the region to provide guidance to electrical technicians, homeowners, public agencies, and businesses wishing to reduce the life-cycle footprint of their transportation emissions.

Evaluation of fleets in the Evergreen Fleets program has shown that there is consistent lack of driver training being offered to staff and drivers of fleet vehicles. The development of a sustained driver training program to be housed under the Evergreen Fleets program is also included and budgeted in this grant (to be developed by partners under Project Area D).

Project Area B – Electrification of Ground Support Equipment at Sea-Tac Airport

The Port of Seattle's Seattle-Tacoma International Airport (Sea-Tac) aims to be the first airport in the United States to fully electrify its fleet of ground support equipment. With funding requested in this proposal, the Port of Seattle will work with a consortium of airline tenants to electrify approximately 200 pieces of airplane ground support equipment (out of a possible 650) and install new electric charging hubs. The focus of this project area will be the gasoline baggage tractors and loading equipment because they are large consumers of petroleum fuel. The Port of Seattle and its tenant airline carriers/consortium would match costs in terms of actual vehicle costs in addition to charging infrastructure costs, and plan to continue this project beyond the equipment indicated in this grant.

Most of the ground support equipment (GSE) servicing Sea-Tac airline carriers operate on gasoline, generating greenhouse gas and toxic air emissions, to which airline workers are exposed. Market research indicates that over 90 percent of Sea-Tac's GSE needs could be met by electric powered versions of the equipment (approximately 700 in total).

This airport electrification project will result in an annual petroleum reduction of 418,290 gallons of gasoline and petroleum diesel, resulting in 8.4 million gallons of petroleum reduction over the usable life of the vehicles, and a reduction of over 4500 metric tonnes of CO₂ per year (using an emission factor for electricity generated in Washington State).

The project will incorporate significant outreach and marketing to airline passengers. The outreach component will include a video-loop about Clean Cities and the airport's program, which will play on screens at each of the 16 baggage claim carousels. More than 30 million passengers per year travel to Sea-Tac as a destination airport, offering an unprecedented audience for Clean Cities. There will also be informational window decals at airplane viewing areas, and information about the airport's Clean Taxi program at taxi stands

Project Area C – Biogas for Buses --Vander Haak Dairy Biomethane Transportation Pilot

In cooperation with Washington State University's Extension and Agricultural Research Center (WSU), the Western Washington University's Vehicle Research Institute(WWU-VRI) plans to power bus service on biomethane along the Interstate 5 highway corridor from Seattle to Bellingham, Washington. Bellair Charters will own and operate the vehicle. Fuel will be provided by the Vander Haak Dairy anaerobic digester, refined for vehicle use by a WWU-VRI designed and built refinery. The shuttle will be operational during the 2010 Winter Olympics. The refueling station will be the northernmost operating natural gas station near the Interstate 5 corridor. The pilot should demonstrate the costs and benefits of operating vehicles on fuel from animal waste fed anaerobic digesters.

Funding will support a biomethane refueling station to facilitate commercial sales of biomethane to multiple users. Funding will also support the conversion of coach buses to operate on natural gas/biomethane. Goals include improving air quality, providing a renewable, domestic transportation fuel, supporting regional greenhouse gas emission targets, and addressing dairy waste management issues.

The biomethane refinery is located in Whatcom County, Washington. With a dairy herd of 80,000 cows, this county contains one of the largest dairy populations in the nation. The herd could produce over 40,000 gasoline gallons of equivalent (GGE) energy per day and over 15 million GGE per year--enough to fuel 25,000 passenger vehicles at 20 miles per gallon equivalent. Regional lagoon management practices annually produce over 400 million pounds volatile solids, 1.4 billion standard cubic of methane and over 1.3 billion pounds of carbon dioxide equivalent global warming potential (GWP). Anaerobic digesters can address odor, nutrient concentration, global warming potential and other dairy waste management issues. The high cost of these systems, roughly \$1,000 per cow, is financed primarily by electric power sales. Across the nation, electric power sales from digesters face issues in finding a local supportive power utility, sufficient rural power grid capacity and the high (~40 percent of total project) cost of power gensets and grid connection. In the Pacific Northwest, low-cost hydroelectric power provides an additional challenge. Vehicle fuel sells at 2-5 times the cost of biomethane for power on an equivalent energy basis. Creating a transportation pilot will provide dairy farmers with another option to support the installation of anaerobic digesters. The project will provide the region with a renewable, carbon negative transportation fuel.

Phase I of the project will support the installation of a 100,000 commercial refueling station at the Vander Haak Dairy, including metered fueling, time fill and sequential fast fill. During phase II of the project, Area of Interest 2, a Bellair Charters, 36 passenger MCI F Coach and a 20 passenger E450 Krystal cutaway will be converted to natural gas operation. Bellair will operate the vehicles from the Seattle Tacoma International Airport north to Birch Bay, Washington in time for the 2010 Winter Olympics. Support for the project comes from the Paul Allen Foundation via WSU, the Washington State Department of Agriculture, and the Whatcom Power Utility District #1.

Project Area D – Advanced Technologies Education and Outreach Coordinated by Washington State University

D.1 Electric Infrastructure –Residential Recharging Education

Because residential recharging represents the foundation of the electric vehicle recharge network, WSU will coordinate the development of a guidebook for electricians and residents.

- Develop guidebook for residential EV charging facility. Target audience is homeowners and design community. (\$30,000)

Guidebook should include:

- Brief introduction to battery electric and plug-in hybrid vehicles.
- Brief introduction to home recharging including discussion of industry accepted charging levels –Level 1 (120 VAC) and Level 2 (240 VAC).
- Describe EV Charging installation process. Issues discussed will include:
 - Home readiness and load evaluation- is the existing service panel adequate; is a new circuit required; design standards, state and local electric and building code requirements and permit process, home insurance issues.
 - EV charger/interconnection device- identify industry compliant (UL, NEMA, SAE) EV recharging equipment. Discuss utility load management issues and “smart-charging” devices.
 - EV recharging operational, maintenance and safety issues – identify safe recharging procedure and safety devices (GFCI, connection interlock, ventilation interlock, automatic de-energization) to ensure fool-proof, safe operation.
- Electric and building code development. (\$25-\$50,000)
 - Review existing state and local electric and building codes and standards to determine compatibility with both new and retrofit residential EV recharging facilities.
 - Work with key stakeholders (Washington State Department of Labor and Industries, Washington State Building Code Council) to identify any regulatory changes needed to encourage residential “EV readiness”.
 - Identify training needs for electricians and building code officials responsible for installing and inspecting EV residential recharging facilities.

D.2 Vehicle-to-Grid Solar Electrification Technology Development and Workforce Training

Plug-in hybrid and all electric vehicles are a critical step in the electrification of transportation in America and the Pacific Northwest. Plug-in vehicles can with large scale adoption, dramatically reduce carbon loading in the atmosphere, and their use also provides electric utilities with the advantages of distributed generation that can be utilized on demand by the utility. Especially if Washington-based inverter technology is included in charging station technology from the outset. Locally produced charge control technology actually adds additional storage capacity to a charging station even when the vehicle is not present. The Northwest Solar Center at WSU and the Shoreline Community College Automotive Program are prototyping a manufacturing process to produce modular, expandable recharging stations using locally-made solar modules and locally-produced grid coupled balance of systems technology.

Shoreline Community College has been recognized as a state community college center for excellence in alternative energy curriculum development. Shoreline Community College is also the principle training center for Toyota, Nissan, GM, Ford and other dealerships, and is situated in a unique position to leverage its industry contacts with a rapidly growing zero-energy buildings program and become a training center for vehicle-to-grid development, training mechanics in hybrid and electric automobile maintenance

Shoreline Community College, together with the Washington State University Energy Program's Northwest Solar Center, is in the process of developing prototype solar/vehicle-to-grid charging stations as an adjunct to a zero-energy house demonstration and automotive training center on the campus of Shoreline Community College. Prototype charging stations, in development by students and faculty of Shoreline Community College in collaboration with auto manufacturers, will be designed to provide virtually all of the energy necessary to operate plug-in hybrid vehicles. All construction work will be accomplished using union labor and apprentices.

This project will allow Shoreline Community College to initiate design, acquire prototyping technology, and develop curriculum for training dealerships. The acquisition of the materials needed for the program will allow the Northwest Solar Center and Shoreline College to develop manufacturing processes necessary to produce a truly ‘made in Washington’ Modular Solar Recharging Station that can be local built and marketed through established auto dealerships and other market channels.

D.3 Biomethane Curriculum and Workshops

- Pre-market analysis to identify target opportunities (dairy farms, wastewater treatment facilities) to advance/replicate biomethane vehicle project . (Est cost: \$10,000)
- Develop biomethane curriculum for Western Washington University. (Est.cost: \$7000)
- Prepare case study of biomethane vehicle project at VanderHaak dairy anaerobic digester (AD) for journal submittal. Include description of project AD technology including current use of methane for electric power production. Describe development and operation of biomethane upgrading technology, compression/refueling equipment and biomethane vehicle technology. Identify costs, regulations and project economics. (Est cost: \$7,000)
- Prepare series of fact sheets targeting specific aspects of biomethane project. (Est cost: \$25-\$30,000)
 - Co-mingled digester feedstocks
 - Biogas upgrading/scrubbing
 - Biomethane compression/refueling
 - Regulatory issues
 - Economics of biomethane as a transportation fuel
- Prepare/conduct 2-3 workshops (eastside, westside) on biomethane as a transportation fuel. Partner with the Washington State Department of Agriculture Bioenergy program; WSU Center for Sustaining Agriculture and Natural Resources -Climate Friendly Farming initiative; Washington State Department of Ecology-Beyond Waste program and the Washington State Dairy Association. Use WSU County Extension network as workshop delivery arm. (Est. cost: \$7,500/workshop)
- Prepare/conduct 1-2 presentations for state or regional conference covering bioenergy and/or waste reduction. Possible forums include the annual 4-state Harvesting Clean Energy conference. (Est. cost: \$1500/event)